

REMARKS

In response to the Office Action dated 2 September 2003, the applicant requests reconsideration of the above-identified application in view of the following remarks. Claims 36-39, 59-67, 71-85, and 98-99 are pending in the application. Claims 83-85 are allowed, and claims 36-39, 59-67, 71-82, and 98-99 are rejected. Claims 62-67 have been cancelled. None of the remaining claims have been amended.

Allowed Claims

The Office Action indicated that claims 83-85 are allowed.

Rejections of Claims Under §102

Claim 37 was rejected under 35 USC § 102(e) as being anticipated by Weitzel et al. (U.S. 5,661,312, Weitzel). The applicant respectfully traverses.

Claim 37 recites a transistor comprising a source region, a drain region, a channel region between the source and drain regions, and a gate separated from the channel region by an insulator, the gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is selected at a predetermined value approximately between 0.5 and 1.0 to establish a desired value of a barrier energy between the gate and the insulator.

Weitzel relates to a silicon carbide MOSFET with gates 18 that may be made up of silicon carbide as described in column 1, lines 62-63. Weitzel does not show a gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is selected at a predetermined value approximately between 0.5 and 1.0 as is recited in claim 37. The Office Action states that the "value for x of the prior art [Weitzel] is thus seen to be within the claimed range defined in claim 37." Office Action, page 3. The Office Action has not cited any support for this assertion, and this is not the case. Claim 37 recites that x is approximately between 0.5 and 1.0, and this does not include 0.5.

The applicant respectfully submits that Weitzel does not show all of the elements recited in claim 37, and that claim 37 is in condition for allowance.

Rejections of Claims Under §103

Claims 36 and 38-39 were rejected under 35 USC § 103(a) as being unpatentable over Chiang et al. (U.S. 4,598,305, Chiang) in view of Halvis et al. (U.S. 5,369,040, Halvis). The applicant respectfully traverses.

Claim 36 recites a transistor comprising a source region, a drain region, a channel region between the source and drain regions, and a gate separated from the channel region by an insulator, the gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is greater than 0.5 to establish a desired value of a barrier energy between the gate and the insulator.

The MPEP states the following with regard to rejections under 35 USC § 103:

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.” MPEP 2143.

A Federal Circuit opinion states that the suggestion or motivation to combine references and the reasonable expectation of success must both be found in the prior art. MPEP 2143 citing *In re Vaeck*, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

The Federal Circuit has emphasized the need for the PTO to furnish evidence in support of claim rejections under 35 USC § 103 in *In re Lee*:

“When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness....The factual inquiry whether to combine references must be thorough and searching....It must be based on objective evidence of record.” *In re Lee*, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

The MPEP also addresses rejections based on scientific principles:

“The rationale to support a rejection under 35 U.S.C. 103 may rely on logic and sound scientific principle...However, when an examiner relies on a scientific theory, evidentiary support for the existence and meaning of that theory must be provided.” MPEP 2144.02, Page 2100-131.

Chiang relates to a thin film semiconductor photodetector. Chiang shows in Figure 1 a channel region 11 formed by regions 14 and 16 between a source region 26 and a drain region 28. A gate oxide layer 20 and a polysilicon gate electrode 22 are formed on the region 16. As

the Office Action states, Chiang does not show a gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is greater than 0.5 as is recited in claim 36.

Halvis relates to a MOS photodetector and shows a “polysilicon gate material which is made more transparent to visible light by the addition of up to 50% carbon.” Halvis, Abstract. “The amount of carbon added to the silicon can be between 0% and 50%.” Halvis, column 3, lines 40-43. Halvis does not show a gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is greater than 0.5 as is recited in claim 36.

The Office Action states that “it would have been obvious to replace the poly-silicon gate material with $\text{Si}_{1-x}\text{C}_x$ with x being infinitesimally close to the range x greater than 0.5 in view of Halvis.” Office Action, page 4. The Office Action has not provided sufficient evidence to support this rejection under 35 USC § 103, and the applicant respectfully requests that evidence be provided or the rejection be withdrawn.

First, neither Chiang nor Halvis show a gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is greater than 0.5 as is recited in claim 36. As combined, Chiang and Halvis do not show all the claimed limitations, and therefore a *prima facie* case of obviousness has not been established.

Second, since neither Chiang nor Halvis show a gate formed of a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is greater than 0.5, neither Chiang nor Halvis show a reasonable expectation of success of such a gate as is required by *In re Vaeck*, and therefore a *prima facie* case of obviousness has not been established.

The Office Action cited *In re Peterson*, 65 USPQ2d 1379 (Fed. Cir. 2003) which addressed overlapping ranges in a rejection under 35 USC §103. Office Action, page 5. The court stated: “We have also held that a *prima facie* case of obviousness exists when the claimed range and the prior art range do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties.” *In re Peterson*, 65 USPQ2d at 1382.

Halvis shows a polysilicon/carbon material with “up to 50% carbon” and the “amount of carbon added to the silicon can be between 0% and 50%.” Halvis, abstract and column 3, lines 40-43. Claim 36 recites a silicon carbide compound $\text{Si}_{1-x}\text{C}_x$, wherein x is greater than 0.5. The claimed range does not overlap with the range shown by Halvis, and does not include a material of 50% carbon and 50% polysilicon. The Office Action has not provided evidence that the range

recited in claim 36 is close enough to the range of Halvis such that one skilled in the art would have expected them to have the same properties.

The Office Action states that “the energy gap of $\text{Si}_{1-x}\text{C}_x$, and hence said barrier energy is a continuous function of the stoichiometric parameter x . Therefore, said barrier energy has substantially the same value for $x=0.5$ as for x infinitesimally greater than 0.5.” Office Action, page 5. The Office Action is relying on a scientific theory here, and the applicant respectfully requests that evidentiary support for the existence and meaning of this scientific theory be provided as is required by MPEP 2144.02. Such evidence is required by *In re Lee*. Absent such evidence, the applicant respectfully submits that a *prima facie* case of obviousness has not been established.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 36 has not been established in the Office Action, and that claim 36 is in condition for allowance. Claims 38-39 depend on claim 36, and recite further limitations with respect to claim 36. For reasons analogous to those stated above, and the limitations in the claims, the applicant respectfully submits that the Office Action has not established a *prima facie* case of obviousness of claims 38-39, and that claims 38-39 are in condition for allowance.

Claims 59-61 were rejected under 35 USC § 103(a) as being unpatentable over Chiang in view of Halvis. The applicant respectfully traverses.

Claims 59-61 recite elements similar to the elements recited in claim 36. For reasons analogous to those stated above with respect to claim 36, and the limitations in the claims, the applicant respectfully submits that the Office Action has not established a *prima facie* case of obviousness of claims 59-61, and that claims 59-61 are in condition for allowance.

In addition, with regard to claim 61, the Office Action states that “even in an ultra-amorphous state nanocrystals, i.e., crystals at the scale of the interatomic distance, exist. Therefore, the list of crystalline forms that constitutes the essence of this claim is not a true limitation.” Office Action, page 8. The Office Action is relying on a scientific theory here, and the applicant respectfully requests that evidentiary support for the existence and meaning of this scientific theory be provided as is required by MPEP 2144.02. Absent such evidence, the

applicant respectfully requests that this rejection be withdrawn with respect to claim 61 and the other claims for which it is used.

Claims 37 and 99 were rejected under 35 USC § 103(a) as being unpatentable over Chiang in view of Halvis. The applicant respectfully traverses.

Claims 37 and 99 recite elements similar to the elements recited in claim 36. For reasons analogous to those stated above with respect to claim 36, and the limitations in the claims, the applicant respectfully submits that the Office Action has not established a *prima facie* case of obviousness of claims 37 and 99, and that claims 37 and 99 are in condition for allowance.

Claims 62-67 were rejected under 35 USC § 103(a) as being unpatentable over Chiang in view of Halvis. The applicant respectfully traverses.

Claims 62-67 have been cancelled.

Claims 71-73 were rejected under 35 USC § 103(a) as being unpatentable over Nakamura et al. (ISSN 0018-9383, Nakamura) in view of Halvis. The applicant respectfully traverses. Nakamura relates to a CMOS active pixel image sensor with simple floating gate (SFG) pixels. A schematic diagram of the SFG pixel is shown in Figure 1 of Nakamura. The Office Action states that it would have been obvious to replace the floating gate material of Nakamura with the silicon carbide of Halvis. Office Action, page 13. The applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura and Halvis under 35 USC § 103.

The Office Action states that “Because the device by Nakamura et al detects light that traverses the floating gate (FG) material (because the active region is located between the n⁺ source and drain regions)...there is ample motivation to include the teaching by Halvis et al in this respect in the device by Nakamura et al.” Office Action, page 14. There is no evidence that Nakamura detects light that traverses a floating gate.

Nakamura relates to a pixel structure using a simple floating gate (SFG). Nakamura, abstract. Nakamura shows a device in Figure 1. With regard to its operation, Nakamura says

that “photon-induced signal electrons are accumulated in the potential well under the PG” but does not state where the photons entered the device. Nakamura, page 1693.

The applicant has submitted Fossum et al. (U.S. 6,166,768, Fossum), a patent entitled “Active pixel sensor array with simple floating gate pixels” (called herein SFG pixels) having inventors with the same names as the authors of Nakamura. Fossum shows a charge transfer section of a cell in Figure 4 similar to the device in Figure 1 of Nakamura. Fossum describes the operation of the device in Figure 4: “[d]uring the horizontal scanning period, electrons accumulate in the potential well 80 in proportion to photon flux incident on the substrate 20 beneath the photogate electrode 30.” Fossum, column 5, lines 1-4. An SFG pixel is shown in Figure 7 of Fossum that is substantially similar to the structure shown in Figure 1 of Nakamura. It is likely that the device of Nakamura operates in a manner similar to that described in Fossum. There is no evidence that the device by Nakamura et al detects light that traverses the floating gate (FG) material as is asserted in the Office Action.

The applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura and Halvis under 35 USC § 103. The Office Action has not established a *prima facie* case of obviousness of claims 71-73, and claims 71-73 are in condition for allowance.

Claims 74 and 76 were rejected under 35 USC § 103(a) as being unpatentable over Nakamura in view of Halvis. The applicant respectfully traverses.

In view of the remarks made above with respect to claims 71-73, the applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura and Halvis under 35 USC § 103. The Office Action has not established a *prima facie* case of obviousness of claims 74 and 76, and claims 74 and 76 are in condition for allowance.

Claim 75 was rejected under 35 USC § 103(a) as being unpatentable over Nakamura in view of Halvis and Chiang. The applicant respectfully traverses.

In view of the remarks made above with respect to claims 71-73, the applicant respectfully submits that the Office Action has not provided evidence of a suggestion or

motivation to combine Nakamura and Halvis under 35 USC § 103. The Office Action has not identified evidence in Chiang that supplies a motivation to combine Nakamura with Halvis, or Nakamura with Chiang. The applicant respectfully submits that the Office Action has not established a *prima facie* case of obviousness of claim 75, and that claim 75 is in condition for allowance.

Claims 77 and 79 were rejected under 35 USC § 103(a) as being unpatentable over Nakamura in view of Halvis. The applicant respectfully traverses.

In view of the remarks made above with respect to claims 71-73, the applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura and Halvis under 35 USC § 103. The Office Action has not established a *prima facie* case of obviousness of claims 77 and 79, and claims 77 and 79 are in condition for allowance.

Claim 78 was rejected under 35 USC § 103(a) as being unpatentable over Nakamura in view of Halvis and Chiang. The applicant respectfully traverses.

In view of the remarks made above with respect to claim 75, the applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura, Halvis, and Chiang under 35 USC § 103. The Office Action has not established a *prima facie* case of obviousness of claim 78, and claim 78 is in condition for allowance.

Claims 80-82 were rejected under 35 USC § 103(a) as being unpatentable over Nakamura in view of Halvis. The applicant respectfully traverses.

In view of the remarks made above with respect to claims 71-73, the applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura and Halvis under 35 USC § 103. The Office Action has not established a *prima facie* case of obviousness of claims 80-82, and claims 80-82 are in condition for allowance.

Claims 36 and 98 were rejected under 35 USC § 103(a) as being unpatentable over Nakamura in view of Halvis. The applicant respectfully traverses.

In view of the remarks made above with respect to claims 71-73, the applicant respectfully submits that the Office Action has not provided evidence of a suggestion or motivation to combine Nakamura and Halvis under 35 USC § 103. The Office Action has not established a *prima facie* case of obviousness of claims 36 and 98, and claims 36 and 98 are in condition for allowance.

CONCLUSION

The applicant respectfully submits that all of the pending claims are in condition for allowance, and such action is earnestly solicited. The Examiner is invited to telephone the below-signed attorney at 612-373-6973 to discuss any questions which may remain with respect to the present application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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Date 2 December 2003

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